INDEX TO VOLUME 77

Affluence in jeopardy—minerals and the political economy. By C. F. Park, Jr. Review by John D. Ridge, 736

Albee, A. L., C. R. Knowles, J. V. Smith, and A. E. Bence. *X-ray emission microanalysis of rock-forming minerals. VII. Garnets*, 439

Amorós, Marisa. *See* Luis, José, 246

Amphiboles. By W. G. Ernst. Review by Hugh J. Greenwood, 245

Analysis of strain in the Barberton Mountain Land, eastern Transvaal, using deformed pebbles (N. C. Gay), 377

Ancient environments. By Leo F. Laporte. Review by Ralph G. Johnson, 500

Anstey, Robert L., and Michael L. Fowler. *Lithostratigraphy and depositional environment of the Eden Shale (Ordovician) in the tri-state area of Indiana, Kentucky, and Ohio*, 668

Armored mud balls in an intertidal environment, Minas Basin, southeast Canada (Daniel J. Stanley), 683

Askja on fire. By S. Thorarinsson. Review by Tom Simkin, 739

Aspects of bed thickness in some Eocene turbidite sequences, Spanish Pyrenees (N. A. Rupke), 482

Astronomical theory of climactic change: Barbados data (Kenneth J. Mesolella, R. K. Matthews, Wallace S. Broecker, and David L. Thurber), 250

Baker, D. W., H. R. Wenk, and J. M. Christie. *X-ray analysis of preferred orientation in fine-grained quartz aggregates*, 144

Banks, Philip O., and J. Allen Cain. *Zircon ages of Precambrian granitic rocks, northeastern Wisconsin*, 208

Bardossi, Fulvio. *See* Herbert, Don, 739

Barnes, H. L. Review of: Tables for microscopic identification of ore minerals. By W. Uytenbogaardt. Reprint of 1951 ed., 500

Belderson, R. H., and M. A. Johnson. *The tidal origin of some vertical sedimentary changes in epicontinental seas*, 353

Bence, A. E., C. R. Knowles, J. V. Smith, and A. L. Albee. *X-ray emission microanalysis of rock-forming minerals. VII. Garnets*, 439

Bhattacharya, S., D. Mukhopadhyay, and S. Sengupta. *Strain measurements in some Precambrian rocks of eastern India and their bearing on the tectonic significance of schistosity*, 703

Birkeland, Peter W. *Quaternary paleoclimatic implications of soil clay mineral distribution in a Sierra Nevada–Great Basin transect*, 289

Bishop, D. G., and E. R. Force. *The reliability of graded bedding as an indicator of the order of superposition*, 346

Björnsson, Sveinbjörn. Iceland and mid-ocean ridges. Review by Tom Simkin, 739

Breed, William J. Review of: Colorado River guidebook—Lees Ferry to Phantom Ranch. By Troy Péwé, 740

Bretz, J Harlen. *The Lake Missoula floods and the Channeled Scabland*, 505

Broecker, Wallace S., Kenneth J. Mesolella, R. K. Matthews, and David L. Thurber. *The astronomical theory of climatic change: Barbados data*, 250

Brookins, D. G., and K. D. Watson. *The strontium geochemistry of calcite associated with kimberlite at Bachelor Lake, Quebec*, 367

Brookins, Douglas G. *The significance of K-Ar dates on altered kimberlitic phlogopite from Riley County, Kansas*, 102

Brothers, R. N., and K. A. Rodgers. *Petrofabric studies of ultramafic nodules from Auckland, New Zealand*, 452

Cain, J. Allen, and Philip O. Banks. *Zircon ages of Precambrian granitic rocks, northeastern Wisconsin*, 208

Caine, N. *A model for alpine talus slope development by slush avalanching*, 92

Carlozzi, Carl A., and Alice A. Conservation and Caribbean regional progress. Review by A. A. Meyerhoff, 499

Carozzi, Albert V., ed. Telliamed. Review by Cecil J. Schneer, 735

Characteristics and origin of a Precambrian pediment (George E. Williams), 183

Chayes, F. Review of: La regione vulcanica dei Colli Albani. By M. Fornaseri, A. Scherillo, and U. Ventriglia, 495

Christie, J. M., D. W. Baker, and H. R. Wenk. *X-ray analysis of preferred orientation in fine-grained quartz aggregates*, 144

Cleavage and penecontemporaneous deformation structures in sedimentary rocks (P. F. Williams, A. R. Collins, and R. G. Wiltshire), 415

Collins, A. R., P. F. Williams, and R. G. Wiltshire. *Cleavage and penecontemporaneous deformation structures in sedimentary rocks*, 415

Colorado River guidebook—Lees Ferry to Phantom Ranch. By Troy Péwé. Review by William J. Breed, 740

Computer applications in stratigraphic analysis. By John W. Harbaugh and Daniel F. Merriam. Review by Charles W. Ondrick, 375

Configuration of the Prairie du Chien–St. Peter contact in southwestern Wisconsin: an example of an integrated geological-geophysical study (Robert C. Palmquist), 694

Conservation and Caribbean regional progress. By Carl A. and Alice A. Carlozzi. Review by A. A. Meyerhoff, 499

Continental margins, geosynclines, and ocean floor spreading (Andrew H. Mitchell and Harold G. Reading), 629

Conway, Clay M., and Hugh P. Taylor, Jr. O^{18}/O^{16} and C^{13}/C^{12} *ratios of coexisting minerals in the Oka and Magnet Cove carbonatite bodies*, 618

Crown jewels of Iran. By V. B. Meen and A. D. Tushingham. Review by J. V. Smith, 246
Cylindrical columnar joints in Precambrian mafic dikes, Bighorn Mountains, Wyoming (R. A. Heimlich), 371

Daly, R. A. Igneous rocks and the depths of the earth. Review by Peter J. Wyllie, 739
Debate about the earth. By H. Takeuchi, S. Uyeda, and H. Kanamori. Review by Peter J. Wyllie, 501
Denison, Robert H. Review of: Notes and comments on vertebrate paleontology. By Alfred Sherwood Romer, 738
Desert varnish: an electron probe study (Roger LeB. Hooke, Houng-yi Yang, and Paul W. Weiblen), 275
Deserts of the world. Edited by W. G. McGinnies, B. J. Goldman, and P. Paylore. Review by S. A. Schumm, 737
DeVore, George W. *Preferred mineral distributions of polymineralic rocks related to non-hydrostatic stresses as expressions of mechanical equilibria*, 26
Dill, Robert F. *See* Shepard, Francis P., 740
Distinguishing marine and freshwater muds (N. F. Shimp, J. Witters, Paul Edwin Potter, and J. A. Schleicher), 566

Editorial, 249
Eicher, Don L. Geologic time. Review by Ralph G. Johnson, 500
Elders, W. A., and J. C. Rucklidge. *Rheomorphism of granite by gabbro intrusions on the coast of south-central Labrador*, 240
Elders, Wilfred A., and John C. Rucklidge. *Layering and net veining in hornblende lamprophyre intrusions from the coast of Labrador*, 721
Embleton, Clifford, and Chuchlaine A. M. King. Glacial and periglacial geomorphology. Review by Robert P. Sharp, 501
Emery, K. O. Review of: Marine geotechnique. Edited by Adrian F. Richards, 245
Engineering properties of rocks. By I. W. Farmer. Review by Barry Voight, 736
Ernst, W. G. Amphiboles. Review by Hugh J. Greenwood, 245
Eruptions of Hekla in historical times. By S. Thorarinsson. Review by Tom Simkin, 739
Experimental recrystallization of dolomite and comparison of preferred orientations of calcite and dolomite in deformed rocks (Else-Ragnhild Neumann), 426
Experimental studies of igneous rock series: the Farrington Complex, North Carolina, and the Star Mountain Rhyolite, Texas (D. L. Gibbon and P. J. Wyllie), 221
Explanation and prediction in geology (Richard A. Watson), 488

Farmer, I. W. Engeering properties of rocks. Review by Barry Voight, 736
Flatness index of non-spherical sedimentary particles (Mohammad Akram Gill), 120
Flexural slip as indicated by faulted lava flows along the Grand Hogback monocline, Colorado (Frederick N. Murray), 333
Flint, R. F. *See* Longwell, C. R., 502
Force, E. R., and D. G. Bishop. *The reliability of graded bedding as an indicator of the order of superposition*, 346
Fornaseri, M., A. Scherillo, and U. Ventriglia. La regione vulcanica dei Colli Albani. Review by F. Chayes, 495
Fowler, Michael L., and Robert L. Anstey. *Lithostratigraphy and depositional environment of the Eden Shale (Ordovician) in the tri-state area of Indiana, Kentucky, and Ohio*, 668
French, B. M., and N. M. Short, eds. Shock metamorphism of natural materials. Review by Brian Mason, 738
Frequency distributions of stream link lengths (W. R. James and W. C. Krumbein), 544

Gatrall, M., and J. H. McD. Whitaker. *Two "orientometers" for measuring lineations on hand specimens*, 710
Gay, N. C. *The analysis of strain in the Barberton Mountain Land, eastern Transvaal, using deformed pebbles*, 377
Geologic time. By Don L. Eicher. Review by Ralph G. Johnson, 500
Geomorphology of a sand ridge (J. Dungan Smith), 39
Gibbon, D. L., and P. J. Wyllie. *Experimental studies of igneous rock series: the Farrington Complex, North Carolina, and the Star Mountain Rhyolite, Texas*, 221
Gibbons, G. S. *Planar sections through imbricate-type fabrics*, 339
Gill, Mohammad Akram. *Flatness index of non-spherical sedimentary particles*, 120
Glacial and periglacial geomorphology. By Clifford Embleton and Chuchlaine A. M. King. Review by Robert P. Sharp, 501
Goldman, B. J. *See* McGinnies, W. G., 737
Greenspan, H. P. The theory of rotating fluids. Review by R. S. Lindzen, 247
Greenwood, Hugh J. Review of: Amphiboles. By W. G. Ernst, 245
Griffiths, John C. Review of: Methods in sedimentary petrology. By G. Muller. Translated by by Hans-Ulrich Schmincke, 375

Habib, D., H. D. Needham, and B. C. Heezen. *Upper Carboniferous palynomorphs as a tracer of red sediment dispersal patterns in the northwest Atlantic*, 113
Hadidiacos, C. G. *Solid-state temperature controller*, 365
Hall, A. *Regional variation in the composition of British Caledonian granites*, 466
Harbaugh, John W., and Daniel F. Merriam. Computer applications in stratigraphic analysis. Review by Charles W. Ondrick, 375
Heezen, B. C., H. D. Needham, and D. Habib. *Upper Carboniferous palynomorphs as a tracer of red sediment dispersal patterns in the northwest Atlantic*, 113
Heimlich, R. A. *Cylindrical columnar joints in Precambrian mafic dikes, Bighorn Mountains, Wyoming*, 371
Herbert, Don, and Fulvio Bardossi. Kilauea: case history of a volcano. Review by Tom Simkin, 739
Historical geology of the Antillean-Caribbean region, or the lands bordering the Gulf of

Mexico and the Caribbean Sea. By Charles Schuchert. Review by A. A. Meyerhoff, 498
History of life. By A. Lee McAlester. Review by Ralph G. Johnson, 500
Hooke, Roger LeB., Houng-yi Yang, and Paul W. Weiblen. *Desert varnish: an electron probe study*, 275

Iceland and mid-ocean ridges. Edited by Sveinbjörn Björnsson. Review by Tom Simkin, 739
Igneous rocks and the depths of the earth. By R. A. Daly. Review by Peter J. Wyllie, 739
Inexpensive shallow water table probe (Fred Libby), 626
Intraformational periglacial structures in the Nose Hill gravels and sands, Calgary, Alberta, Canada (Alan V. Morgan), 358
Introduction to geology. By W. L. Stokes and S. Judson. Review by Peter J. Wyllie, 502
Introduction to J Harlen Bretz's paper on "The Lake Missoula floods and the Channeled Scabland" (Everett C. Olson), 503
Introduction to meteorology. By Sverre Petterssen. 3d ed. Review by Richard S. Lindzen, 499

James, W. R., and W. C. Krumbein, *Frequency distributions of stream link lengths*, 544
Johannsen, A. Manual of petrographic methods. Review by Peter J. Wyllie, 739
Johnson, M. A., and R. H. Belderson. *The tidal origin of some vertical sedimentary changes in epicontinental seas*, 353
Johnson, Ralph G. Review of: Geologic time, by Don L. Eicher; The history of life, by A. Lee McAlester; Ancient environments, by Leo F. Laporte, 500
Johnston, W. G. Q. *Pillow lava and pahoehoe: a discussion*, 730
Jones, J. G. *Pillow lava and pahoehoe: a reply*, 732
Judson, S. *See* Stokes, W. L., 502
Juxtaposition of turbidite and shallow-water sediments: study of a regressive sequence in the Pennsylvanian of north Devon, England (Roger G. Walker), 125

Kanamori, H. *See* Takeuchi, H., 501
Kilauea: case history of a volcano. By Don Herbert and Fulvio Bardossi. Review by Tom Simkin, 739
King, Chuchlaine A. M. *See* Embleton, Clifford, 501
Knowles, C. R., J. V. Smith, A. E. Bence, and A. L. Albee. *X-ray emission microanalysis of rock-forming minerals. VII. Garnets*, 439
Koster van Groos, A. F., and P. J. Wyllie. *Melting relationships in the system $NaAlSi_3O_8$-NaCl-H_2O at one kilobar pressure, with petrological applications*, 581
Krumbein, W. C., and W. R. James. *Frequency distributions of stream link lengths*, 544

Lake Missoula floods and the Channeled Scabland (J Harlen Bretz), 505
Landforms of Australia. By Vincent Serventy. Review by S. A. Schumm, 502
Laporte, Leo F. Ancient environments. Review by by Ralph G. Johnson, 500
La regione vulcanica dei Colli Albani. By M. Fornaseri, A. Scherillo, and U. Ventriglia. Review by F. Chayes, 495
Layering and net veining in hornblende lamprophyre intrusions from the coast of Labrador (Wilfred A. Elders and John C. Rucklidge), 721
Lee, P. J. *The theory and application of canonical trend surfaces*, 303
Libby, Fred. *An inexpensive shallow water table probe*, 626
Lindzen, R. S. Review of: The theory of rotating fluids. By H. P. Greenspan, 247
Lindzen, Richard S. Review of: Introduction to meteorology. 3d ed. By Sverre Petterssen, 499
Lithostratigraphy and depositional environment of the Eden Shale (Ordovician) in the tri-state area of Indiana, Kentucky, and Ohio (Robert L. Anstey and Michael L. Fowler), 668
Lloyd, R. Michael. *A paleoecological interpretation of the Caloosahatchee Formation, using stable isotope methods*, 1
Longwell, C. R., R. F. Flint, and J. E. Sanders. Physical geology. Review by Peter J. Wyllie, 502
Luis, José, and Marisa Amorós. Molecular crystals: their transforms and diffuse scattering. Review by J. V. Smith, 246

McAlester, A. Lee. The history of life. Review by Ralph G. Johnson, 500
McGinnies, W. G., B. J. Goldman, and P. Paylore, eds. Deserts of the world. Review by S. A. Schumm, 737
Manual of petrographic methods. By A. Johannsen. Review by Peter J. Wyllie, 739
Margulis, Lynn. *New phylogenies of the lower organisms: possible relation to organic deposits in Precambrian sediment*, 606
Marine geotechnique. Edited by Adrian F. Richards. Review by K. O. Emery, 245
Mason, Brian. Review of: Shock metamorphism of natural materials. Edited by B. M. French and N. M. Short, 738
Mather, Kirtley F. Source book in geology, 1900–1950. Review by Cecil J. Schneer, 735
Matthews, R. K., Kenneth J. Mesolella, Wallace S. Broecker, and David L. Thurber. *The astronomical theory of climactic change: Barbados data*, 250
Meen, V. B., and A. D. Tushingham. Crown jewels of Iran. Review by J. V. Smith, 246
Melting relationships in the system $NaAlSi_3O_8$-NaCl-H_2O at one kilobar pressure, with petrological applications (A. F. Koster van Groos and P. J. Wyllie), 581
Merriam, Daniel F. *See* Harbaugh, John W., 375
Mesolella, Kenneth J., R. K. Matthews, Wallace S. Broecker, and David L. Thurber. *The astronomical theory of climatic change: Barbados data*, 250
Meteorites and the origin of planets. By John A. Wood. Review by Edward Olsen, 738
Methods in sedimentary petrology. By G. Muller. Translated by Hans-Ulrich Schmincke. Review by John C. Griffiths, 375
Meyerhoff, A. A. Review of: Conservation and Caribbean regional progress. By Carl A. and Alice A. Carlozzi, 499
Meyerhoff, A. A. Review of: Historical geology of the Antillean-Caribbean region, or the lands bordering the Gulf of Mexico and the Caribbean Sea. By Charles Schuchert, 498

Miller, Robert L. Review of: Submarine canyons and other sea valleys. By Francis P. Shepard and Robert F. Dill, 740
Milnes, A. G. *On the orogenic history of the central Alps* (A. G. Milnes), 108
Mineral specimens. Edited by C. J. Morrissey. Review by J. V. Smith, 247
Mitchell, A. H. G. *Raised reef-capped terraces and Plio-Pleistocene sea level changes, north Malekula, New Hebrides*, 56
Mitchell, Andrew H., and Harold G. Reading. *Continental margins, geosynclines, and ocean floor spreading*, 629
Model for alpine talus slope development by slush avalanching (N. Caine), 92
Molecular crystals: their transforms and diffuse scattering. By José Luis and Marisa Amorós. Review by J. V. Smith, 246
Morgan, Alan V. *Intraformational periglacial structures in the Nose Hill gravels and sands, Calgary, Alberta, Canada*, 358
Morrissey, C. J., ed. Mineral specimens. Review by J. V. Smith, 247
Moussa, Mounir T. *Quebrada de los Cedros, southwestern Puerto Rico, and its bearing on some aspects of karst development*, 714
Mukhopadhyay, D., S. Sengupta, and S. Bhattacharya. *Strain measurements in some Precambrian rocks of eastern India and their bearing on the tectonic significance of schistosity*, 703
Muller, G. *See* Schmincke, Hans-Ulrich, 375
Murray, Frederick N. *Flexural slip as indicated by faulted lava flows along the Grand Hogback monocline, Colorado*, 333

Needham, H. D., D. Habib, and B. C. Heezen. *Upper Carboniferous palynomorphs as a tracer of red sediment dispersal patterns in the northwest Atlantic*, 113
Neumann, Else-Ragnhild. *Experimental recrystallization of dolomite and comparison of preferred orientations of calcite and dolomite in deformed rocks*, 426
New phylogenies of the lower organisms: possible relation to organic deposits in Precambrian sediment (Lynn Margulis), 606
Notes and comments on vertebrate paleontology. By Alfred Sherwood Romer. Review by Robert H. Denison, 738

O^{18}/O^{16} and C^{13}/C^{12} ratios of coexisting minerals in the Oka and Magnet Cove carbonatite bodies (Clay M. Conway and Hugh P. Taylor, Jr.), 618
Olsen, Edward. Review of: Meteorites and the origin of planets. By John A. Wood, 738
Olson, Everett C. *Introduction to J Harlen Bretz's paper on "The Lake Missoula floods and the Channeled Scabland,"* 503
Ondrick, Charles W. Review of: Computer applications in stratigraphic analysis. By John W. Harbaugh and Daniel F. Merriam, 375
On the orogenic history of the central Alps (A. G. Milnes), 108

Paleoecological interpretation of the Caloosahatchee Formation, using stable isotope methods (R. Michael Lloyd), 1
Palmquist, Robert C. *The configuration of the Prairie du Chien–St. Peter contact in southwestern Wisconsin: an example of an integrated geological-geophysical study*, 694
Park, C. F., Jr. Affluence in jeopardy—minerals and the political economy. Review by John D. Ridge, 736
Partitioning of sodium between coexisting K-feldspar and plagioclase from some metamorphic rocks (D. Virgo), 173
Paylore, P. *See* McGinnies, W. G., 737
Petrofabric studies of ultramafic nodules from Auckland, New Zealand (R. N. Brothers and K. A. Rodgers), 45
Petterssen, Sverre. Introduction to meteorology. 3d ed. Review by Richard S. Lindzen, 499
Péwé, Troy. Colorado River guidebook—Lees Ferry to Phantom Ranch. Review by William J. Breed, 740
Physical geology. By C. R. Longwell, R. F. Flint, and J. E. Sanders. Review by Peter J. Wyllie, 502
Pillow lava and pahoehoe: a discussion (W. G. Q. Johnston), 730
A reply (J. G. Jones), 732
Planar sections through imbricate-type fabrics (G. S. Gibbons), 339
Potter, Paul Edwin, N. F. Shimp, J. Witters, and J. A. Schleicher. *Distinguishing marine and freshwater muds*, 566
Preferred mineral distributions of polymineralic rocks related to non-hydrostatic stresses as expressions of mechanical equilibria (George W. DeVore), 26
Present-day and subfossil beach cusps on the West African coast (G. A. Worrall), 484
Principles of geomorphology. By W. D. Thornbury. 2d ed. Review by S. A. Schumm, 737
Prodromus of Nicolaus Steno's dissertation concerning a solid body enclosed by process of nature within a solid. Edited by George W. White. Review by Cecil J. Schneer, 735

Quaternary paleoclimatic implications of soil clay mineral distribution in a Sierra Nevada–Great Basin transect (Peter W. Birkeland), 289
Quebrada de los Cedros, southwestern Puerto Rico, and its bearing on some aspects of karst development (Mounir T. Moussa), 714

Ragan, Donal M. *Structures at the base of an ice fall*, 647
Raised reef-capped terraces and Plio-Pleistocene sea level changes, north Malekula, New Hebrides (A. H. G. Mitchell), 56
Rao, S. Subba. *The terminology of oligoclase-basalt and mugearite*, 101
Reading, Harold G., and Andrew H. Mitchell. *Continental margins, geosynclines, and ocean floor spreading*, 629
Regional variation in the composition of British Caledonian granites (A. Hall), 466
Reliability of graded bedding as an indicator of the order of superposition (D. G. Bishop and E. R. Force), 346
Reviews, 245, 375, 495, 735

Rheomorphism of granite by gabbro intrusions on the coast of south-central Labrador (W. A. Elders and J. C. Rucklidge), 240
Richards, Adrian F., ed. Marine geotechnique. Review by K. O. Emery, 245
Ridge, John D. Review of: Affluence in jeopardy—minerals and the political economy. By C. F. Park, Jr., 736
Rodgers, K. A., and R. N. Brothers. *Petrofabric studies of ultramafic nodules from Auckland, New Zealand*, 452
Romer, Alfred Sherwood. Notes and comments on vertebrate paleontology. Review by Robert H. Denison, 738
Rucklidge, J. C., and W. A. Elders. *Rheomorphism of granite by gabbro intrusions on the coast of south-central Labrador*, 240.
Rucklidge, John C., and Wilfred A. Elders. *Layering and net veining in hornblende lamprophyre intrusions from the coast of Labrador*, 721
Rupke, N. A. *Aspects of bed thickness in some Eocene turbidite sequences, Spanish Pyrenees*, 482

Sanders, J. E. *See* Longwell, C. R., 502
Scherillo, A. *See* Fornaseri, M., 495
Schleicher, J. A., N. F. Shimp, J. Witters, and Paul Edwin Potter. *Distinguishing marine and freshwater muds*, 566
Schmincke, Hans-Ulrich, trans. Methods in sedimentary petrology. By G. Muller. Review by John C. Griffiths, 375
Schneer, Cecil J. Review of: Source book in geology, 1900–1950. By Kirtley F. Mather, 735. Telliamed. Edited by Albert V. Carozzi, 735. Steno's The Prodromus. Edited by George W. White, 735. A view of the soil and climate of the United States of America. Edited by George W. White, 735.
Schuchert, Charles. Historical geology of the Antillean-Caribbean region, or the lands bordering the Gulf of Mexico and the Caribbean Sea. Review by A. A. Meyerhoff, 498
Schumm, S. A. Review of: Deserts of the world. Edited by W. G. McGinnies, B. J. Goldman, and P. Paylore, 737
Schumm, S. A. Review of: Landforms of Australia. By Vincent Serventy, 502
Schumm, S. A. Review of: Principles of geomorphology. 2d ed. By W. D. Thornbury, 737
Semiquantitative differentiation of glacial moraines near Convict Lake, Sierra Nevada, California (Robert P. Sharp), 68
Sengupta, S., D. Mukhopadhyay, and S. Bhattacharya. *Strain measurements in some Precambrian rocks of eastern India and their bearing on the tectonic significance of schistosity*, 703
Serventy, Vincent. Landforms of Australia. Review by S. A. Schumm, 502
Sharp, Robert P. Review of: Glacial and periglacial geomorphology. By Clifford Embleton and Chuchlaine A. M. King, 501
Sharp, Robert P. *Semiquantitative differentiation of glacial moraines near Convict Lake, Sierra Nevada, California*, 68
Shepard, Francis P., and Robert F. Dill. Submarine canyons and other sea valleys. Review by Robert L. Miller, 740
Shimp, N. F., J. Witters, Paul Edwin Potter, and J. A. Schleicher. *Distinguishing marine and freshwater muds*, 566
Shock metamorphism of natural materials. Edited by B. M. French and N. M. Short. Review by Brian Mason, 738
Short, N. M. *See* French, B. M., 738
Shreve, Ronald L. *Stream lengths and basin areas in topologically random channel networks*, 397
Significance of K-Ar dates on altered kimberlitic phlogopite from Riley County, Kansas (Douglas G. Brookins), 102
Simkin, Tom. Review of: Iceland and mid-ocean ridges. Edited by Sveinbjörn Björnsson. The eruptions of Hekla in historical times. By S. Thorarinsson. Askja on fire. By S. Thorarinsson. Kilauea: case history of a volcano. By Don Herbert and Fulvio Bardossi, 739
Smith, J. Dungan. *Geomorphology of a sand ridge*, 39
Smith, J. V. Review of: Crown jewels of Iran. By V. B. Meen and A. D. Tushingham, 246
Smith, J. V. Review of: Mineral specimens. Edited by C. J. Morrissey, 247
Smith, J. V. Review of: Molecular crystals: their transforms and diffuse scattering. By José Luis and Marisa Amorós, 246
Smith, J. V., C. R. Knowles, A. E. Bence, and A. L. Albee. *X-ray emission microanalysis of rock-forming minerals. VII. Garnets*, 439
Solid-state temperature controller (C. G. Hadidiacos), 365
Source book in geology, 1900–1950. By Kirtley F. Mather. Review by Cecil J. Schneer, 735
Stanley, Daniel J. *Armored mud balls in an intertidal environment, Minas Basin, southeast Canada*, 683
Stokes, W. L., and S. Judson. Introduction to geology. Review by Peter J. Wyllie, 502
Strain measurements in some Precambrian rocks of eastern India and their bearing on the tectonic significance of schistosity (D. Mukhopadhyay, S. Sengupta, and S. Bhattacharya), 703
Stream lengths and basin areas in topologically random channel networks (Ronald L. Shreve), 397
Strontium geochemistry of calcite associated with kimberlite at Bachelor Lake, Quebec (D. G. Brookins and K. D. Watson), 367
Structures at the base of an ice fall (Donal M. Ragan), 647
Sturt, Brian A. *Wrench fault deformation and annealing recrystallization during almandine amphibolite facies regional metamorphism*, 319
Submarine canyons and other sea valleys. By Francis P. Shepard and Robert F. Dill. Review by Robert L. Miller, 740

Tables for microscopic identification of ore minerals. By W. Uytenbogaardt. Reprint of 1951 edition. Review by H. L. Barnes, 500
Takeuchi, H., S. Uyeda, and H. Kanamori. Debate about the earth. Review by Peter J. Wyllie, 501
Taylor, Hugh P., Jr., and Clay M. Conway. *O^{18}/O^{16} and C^{13}/C^{12} ratios of coexisting minerals in the Oka and Magnet Cove carbonatite bodies*, 618
Telliamed, or conversations between an Indian philosopher and a French missionary on the diminution of the sea. Edited by Albert V. Carozzi. Review by Cecil J. Schneer, 735

Terminology of oligoclase-basalt and mugearite (S. Subba Rao), 101
Theory and application of canonical trend surfaces (P. J. Lee), 303
Theory of rotating fluids. By H. P. Greenspan. Review by R. S. Lindzen, 247
Thorarinsson, S. Askja on fire. Review by Tom Simkin, 739
Thorarinsson, S. Eruptions of Hekla in historical times. Review by Tom Simkin, 739
Thornbury, W. D. Principles of geomorphology. 2d ed. Review by S. A. Schumm, 737
Thurber, David L., Kenneth J. Mesolella, R. K. Matthews, and Wallace S. Broecker. *The astronomical theory of climatic change: Barbados data*, 250
Tidal origin of some vertical sedimentary changes in epicontinental seas (M. A. Johnson and R. H. Belderson), 353
Tushingham, A. D. *See* Meen, V. B., 246
Two "orientometers" for measuring lineations on hand specimens (J. H. McD. Whitaker and M. Gatrall), 710

Upper Carboniferous palynomorphs as a tracer of red sediment dispersal patterns in the northwest Atlantic (H. D. Needham, D. Habib, and B. C. Heezen), 113
Uyeda, S. *See* Takeuchi, H., 501
Uytenbogaardt, W. Tables for microscopic identification of ore minerals. Reprint of 1951 edition. Review by H. L. Barnes, 500

Ventriglia, U. *See* Fornaseri, M., 495
View of the soil and climate of the United States of America. Edited by George W. White. Review by Cecil J. Schneer, 735
Virgo, D. *Partitioning of sodium between coexisting K-feldspar and plagioclase from some metamorphic rocks*, 173
Voight, Barry. Review of: Engineering properties of rocks. By I. W. Farmer, 736

Walker, Roger G. *The juxtaposition of turbidite and shallow-water sediments: study of a regressive sequence in the Pennsylvanian of north Devon, England*, 125
Watson, K. D., and D. G. Brookins. *The strontium geochemistry of calcite associated with kimberlite at Bachelor Lake, Quebec*, 367
Watson, Richard A. *Explanation and prediction in geology*, 488
Weiblen, Paul W., Roger LeB. Hooke, and Houngyi Yang. *Desert varnish: an electron probe study*, 275
Wenk, H. R., D. W. Baker, and J. M. Christie. *X-ray analysis of preferred orientation in fine-grained quartz aggregates*, 144
Whitaker, J. H. McD., and M. Gatrall. *Two "orientometers" for measuring lineations on hand specimens*, 710
White, George W., ed. Steno's The Prodromus. Review by Cecil J. Schneer, 735
White, George W., ed. A view of the soil and climate of the United States of America. Review by Cecil J. Schneer, 735
Williams, George E. *Characteristics and origin of a Precambrian pediment*, 183
Williams, P. F., A. R. Collins, and R. G. Wiltshire. *Cleavage and penecontemporaneous deformation structures in sedimentary rocks*, 415
Wiltshire, R. G., P. F. Williams, and A. R. Collins. *Cleavage and penecontemporaneous deformation structures in sedimentary rocks*, 415
Witters, J., N. F. Shimp, Paul Edwin Potter, and J. A. Schleicher. *Distinguishing marine and freshwater muds*, 566
Wood, John A. Meteorites and the origin of planets. Review by Edward Olsen, 738
Worrall, G. A. *Present-day and subfossil beach cusps on the West African coast*, 484
Wrench fault deformation and annealing recrystallization during almandine amphibolite facies regional metamorphism (Brian A. Sturt), 319
Wyllie, Peter J. Review of: Debate about the earth. By H. Takeuchi, S. Uyeda, and H. Kanamori, 501
Wyllie, Peter J. Review of: Introduction to geology. By W. L. Stokes and S. Judson, 502
Wyllie, Peter J. Review of: Manual of petrographic methods. By A. Johannsen. Igneous rocks and the depths of the earth. By R. A. Daly, 739
Wyllie, Peter J. Review of: Physical geology. By C. R. Longwell, R. F. Flint, and J. E. Sanders, 502
Wyllie, P. J., and A. F. Koster van Groos. *Melting relationships in the system $NaAlSi_2O_6$-NaCl-H_2O at one kilobar pressure, with petrological applications*, 581
Wyllie, P. J., and D. L. Gibbon. *Experimental studies of igneous rock series: the Farrington Complex, North Carolina, and the Star Mountain Rhyolite, Texas*, 221

X-ray analysis of preferred orientation in fine-grained quartz aggregates (D. W. Baker, H. R. Wenk, and J. M. Christie), 144
X-ray emission microanalysis of rock-forming minerals. VII. Garnets (C. R. Knowles, J. V. Smith, A. E. Bence, and A. L. Albee), 439

Yang, Houng-yi, Roger LeB. Hooke, and Paul W. Weiblen. *Desert varnish: an electron probe study*, 275

Zircon ages of Precambrian granitic rocks, northeastern Wisconsin (Philip O. Banks and J. Allen Cain), 208

THE
JOURNAL OF GEOLOGY

A BI-MONTHLY

PETER J. WYLLIE, Editor

F. ROSEMARY WYLLIE, Managing Editor

BOARD OF ASSOCIATE EDITORS

1958–1969

T. F. W. BARTH, Universitetet i Oslo
J HARLEN BRETZ, University of Chicago
FELIX CHAYES, Geophysical Laboratory, Washington, D.C.
A. E. J. ENGEL, University of California, La Jolla
M. KING HUBBERT, U.S.G.S., Washington, D.C.
JOHN IMBRIE, Columbia University
PH. H. KUENEN, Geologisch Instituut, Groningen
CLIFFORD S. LORD, Geological Survey of Canada, Ottawa
N. NASU, University of Tokyo
OLAF H. ODMAN, Geological Survey of Sweden, Stockholm
JOHN SUTTON, Imperial College, London
ANDREW B. VISTELIUS, Academy of Sciences of U.S.S.R., Leningrad

VOLUME 77

JANUARY–NOVEMBER 1969

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

PUBLISHED JANUARY, MARCH, MAY, JULY, SEPTEMBER,
AND NOVEMBER 1969

COMPOSED AND PRINTED BY THE UNIVERSITY OF CHICAGO
PRESS, CHICAGO, ILLINOIS, U.S.A.

© 1969 by the University of Chicago. All rights reserved.

CONTENTS OF VOLUME 77

NUMBER 1

A Paleoecological Interpretation of the Caloosahatchee Formation, Using Stable Isotope Methods. R. Michael Lloyd 1

Preferred Mineral Distributions of Polymineralic Rocks Related to Non-hydrostatic Stresses as Expressions of Mechanical Equilibria. George W. DeVore 26

Geomorphology of a Sand Ridge. J. Dungan Smith 39

Raised Reef-capped Terraces and Plio-Pleistocene Sea Level Changes, North Malekula, New Hebrides. A. H. G. Mitchell 56

Semiquantitative Differentiation of Glacial Moraines Near Convict Lake, Sierra Nevada, California. Robert P. Sharp 68

Geological Notes

A Model for Alpine Talus Slope Development by Slush Avalanching. N. Caine . . . 92

The Terminology of Oligoclase-Basalt and Mugearite. S. Subba Rao 101

The Significance of K-Ar Dates on Altered Kimberlitic Phlogopite from Riley County, Kansas. Douglas G. Brookins 102

On the Orogenic History of the Central Alps. A. G. Milnes 108

Upper Carboniferous Palynomorphs as a Tracer of Red Sediment Dispersal Patterns in the Northwest Atlantic. H. D. Needham, D. Habib, and B. C. Heezen 113

Flatness Index of Non-spherical Sedimentary Particles. Mohammad Akram Gill . . . 120

NUMBER 2

The Juxtaposition of Turbidite and Shallow-Water Sediments: Study of a Regressive Sequence in the Pennsylvanian of North Devon, England. Roger G. Walker 125

X-Ray Analysis of Preferred Orientation in Fine-grained Quartz Aggregates. D. W. Baker, H. R. Wenk, and J. M. Christie 144

Partitioning of Sodium between Coexisting K-Feldspar and Plagioclase from Some Metamorphic Rocks. D. Virgo 173

Characteristics and Origin of a Precambrian Pediment. George E. Williams 183

Zircon Ages of Precambrian Granitic Rocks, Northeastern Wisconsin. Philip O. Banks and J. Allen Cain 208

Experimental Studies of Igneous Rock Series: The Farrington Complex North Carolina, and the Star Mountain Rhyolite, Texas. D. L. Gibbon and P. J. Wyllie 221

Geological Notes

Rheomorphism of Granite by Gabbro Intrusions on the Coast of South-Central Labrador W. A. Elders and J. C. Rucklidge 240

Reviews 245

NUMBER 3

EDITORIAL 249

THE ASTRONOMICAL THEORY OF CLIMATIC CHANGE: BARBADOS DATA. Kenneth J. Mesolella, R. K. Matthews, Wallace S. Broecker, and David L. Thurber 250

DESERT VARNISH: AN ELECTRON PROBE STUDY. Roger LeB. Hooke, Houng-yi Yang, and Paul W. Weiblen 275

QUATERNARY PALEOCLIMATIC IMPLICATIONS OF SOIL CLAY MINERAL DISTRIBUTION IN A SIERRA NEVADA–GREAT BASIN TRANSECT. Peter W. Birkeland 289

THE THEORY AND APPLICATION OF CANONICAL TREND SURFACES. P. J. Lee 303

WRENCH FAULT DEFORMATION AND ANNEALING RECRYSTALLIZATION DURING ALMANDINE AMPHIBOLITE FACIES REGIONAL METAMORPHISM. Brian A. Sturt 319

GEOLOGICAL NOTES

FLEXURAL SLIP AS INDICATED BY FAULTED LAVA FLOWS ALONG THE GRAND HOGBACK MONOCLINE, COLORADO. Frederick N. Murray 333

PLANAR SECTIONS THROUGH IMBRICATE-TYPE FABRICS. G. S. Gibbons 339

THE RELIABILITY OF GRADED BEDDING AS AN INDICATOR OF THE ORDER OF SUPERPOSITION. D. G. Bishop and E. R. Force 346

THE TIDAL ORIGIN OF SOME VERTICAL SEDIMENTARY CHANGES IN EPICONTINENTAL SEAS. M. A. Johnson and R. H. Belderson 353

INTRAFORMATIONAL PERIGLACIAL STRUCTURES IN THE NOSE HILL GRAVELS AND SANDS, CALGARY, ALBERTA, CANADA. Alan V. Morgan 358

SOLID-STATE TEMPERATURE CONTROLLER. C. G. Hadidiacos 365

THE STRONTIUM GEOCHEMISTRY OF CALCITE ASSOCIATED WITH KIMBERLITE AT BACHELOR LAKE, QUEBEC. D. G. Brookins and K. D. Watson 367

CYLINDRICAL COLUMNAR JOINTS IN PRECAMBRIAN MAFIC DIKES, BIGHORN MOUNTAINS, WYOMING. R. A. Heimlich 371

REVIEWS 375

NUMBER 4

THE ANALYSIS OF STRAIN IN THE BARBERTON MOUNTAIN LAND, EASTERN TRANSVAAL, USING DEFORMED PEBBLES. N. C. Gay 377

STREAM LENGTHS AND BASIN AREAS IN TOPOLOGICALLY RANDOM CHANNEL NETWORKS. Ronald L. Shreve 397

CLEAVAGE AND PENECONTEMPORANEOUS DEFORMATION STRUCTURES IN SEDIMENTARY ROCKS. P. F. Williams, A. R. Collins, and R. G. Wiltshire 415

EXPERIMENTAL RECRYSTALLIZATION OF DOLOMITE AND COMPARISON OF PREFERRED ORIENTATIONS OF CALCITE AND DOLOMITE IN DEFORMED ROCKS. Else-Ragnhild Neumann 426

X-RAY EMISSION MICROANALYSIS OF ROCK-FORMING MINERALS. VII. GARNETS. C. R. Knowles, J. V. Smith, A. E. Bence, and A. L. Albee 439

PETROFABRIC STUDIES OF ULTRAMAFIC NODULES FROM AUCKLAND, NEW ZEALAND. R. N. Brothers and K. A. Rodgers 452

REGIONAL VARIATION IN THE COMPOSITION OF BRITISH CALEDONIAN GRANITES. A. Hall 466

GEOLOGICAL NOTES

ASPECTS OF BED THICKNESS IN SOME EOCENE TURBIDITE SEQUENCES, SPANISH PYRENEES. N. A. Rupke 482

PRESENT-DAY AND SUBFOSSIL BEACH CUSPS ON THE WEST AFRICAN COAST. G. A. Worrall . . 484

EXPLANATION AND PREDICTION IN GEOLOGY. Richard A. Watson 488

REVIEWS 495

NUMBER 5

INTRODUCTION TO J HARLEN BRETZ'S PAPER ON "THE LAKE MISSOULA FLOODS AND THE CHANNELED SCABLAND." Everett C. Olson 503

THE LAKE MISSOULA FLOODS AND THE CHANNELED SCABLAND. J Harlen Bretz 505

FREQUENCY DISTRIBUTIONS OF STREAM LINK LENGTHS. W. R. James and W. C. Krumbein . . . 544

DISTINGUISHING MARINE AND FRESHWATER MUDS. N. F. Shimp, J. Witters, Paul Edwin Potter, and J. A. Schleicher 566

MELTING RELATIONSHIPS IN THE SYSTEM $NaAlSi_3O_8$-NaCl-H_2O AT ONE KILOBAR PRESSURE, WITH PETROLOGICAL APPLICATIONS. A. F. Koster van Groos and P. J. Wyllie 581

NEW PHYLOGENIES OF THE LOWER ORGANISMS: POSSIBLE RELATION TO ORGANIC DEPOSITS IN PRECAMBRIAN SEDIMENT. Lynn Margulis 606

GEOLOGICAL NOTES

O^{18}/O^{16} AND C^{13}/C^{12} RATIOS OF COEXISTING MINERALS IN THE OKA AND MAGNET COVE CARBONATITE BODIES. Clay M. Conway and Hugh P. Taylor, Jr. 618

AN INEXPENSIVE SHALLOW WATER TABLE PROBE. Fred Libby 626

NUMBER 6

CONTINENTAL MARGINS, GEOSYNCLINES, AND OCEAN FLOOR SPREADING. Andrew H. Mitchell and Harold G. Reading 629

STRUCTURES AT THE BASE OF AN ICE FALL. Donal M. Ragan 647

LITHOSTRATIGRAPHY AND DEPOSITIONAL ENVIRONMENT OF THE EDEN SHALE (ORDOVICIAN) IN THE TRI-STATE AREA OF INDIANA, KENTUCKY, AND OHIO. Robert L. Anstey and Michael L. Fowler . 668

ARMORED MUD BALLS IN AN INTERTIDAL ENVIRONMENT, MINAS BASIN, SOUTHEAST CANADA. Daniel J. Stanley 683

GEOLOGICAL NOTES

THE CONFIGURATION OF THE PRAIRIE DU CHIEN–ST. PETER CONTACT IN SOUTHWESTERN WISCONSIN: AN EXAMPLE OF AN INTEGRATED GEOLOGICAL-GEOPHYSICAL STUDY. Robert C. Palmquist 694

STRAIN MEASUREMENTS IN SOME PRECAMBRIAN ROCKS OF EASTERN INDIA AND THEIR BEARING ON THE TECTONIC SIGNIFICANCE OF SCHISTOSITY. D. Mukhopadhyay, S. Sengupta, and S. Bhattacharya 703

TWO "ORIENTOMETERS" FOR MEASURING LINEATIONS ON HAND SPECIMENS. J. H. McD. Whitaker and M. Gatrall 710

QUEBRADA DE LOS CEDROS, SOUTHWESTERN PUERTO RICO, AND ITS BEARING ON SOME ASPECTS OF KARST DEVELOPMENT. Mounir T. Moussa 714

LAYERING AND NET VEINING IN HORNBLENDE LAMPROPHYRE INTRUSIONS FROM THE COAST OF LABRADOR. Wilfred A. Elders and John C. Rucklidge 721

Discussion and Reply
Pillow Lava and Pahoehoe: A Discussion. W. G. Q. Johnston 730
Pillow Lava and Pahoehoe: A Reply. J. G. Jones 732
Reviews 735
Index 741